Battle Command and Visualization

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DESPITE THE BEST EFFORTS of the staff, the plan was unraveling. The scouts reported the enemy moving forward into the security zone instead of staying where the situational template said they would defend from. This invalidated the projected direct and indirect fire plan. The task force commander would have to rely on his lead team commander to find the enemy then develop and issue verbal orders at that point. He felt helpless and unable to provide any other guidance to his lead commander. He was unable to visualize the changes that needed to occur to influence the battle later.

Battlefield visualization, a key component of battle command, is the process of visualizing the unit's current state and a future state (of mission success), formulating concepts of operations to get from one to the other at least cost, and articulating this sequence in intent and guidance.[1] The Army's current attempt at digital command and control (C2) systems will allow better visualization of the battlefield than in the past.

As commander of the 1-22 Infantry Battalion, 4th Infantry Division (ID) (Mechanized (M)), I had the opportunity to test and field Force XXI Battle Command Brigade and Below (FBCB2), which is a digital Battle Command Brigade and Below Control System. FBCB2 uses information-age technology to enable soldiers to receive, compare, and transmit situational awareness (SA) information more quickly than was previously possible and to send and receive C2 messages.

FBCB2 transmits and receives data across the wireless Fixed Tactical Internet (FTI) via the Enhanced Position Location Reporting System (EPLARS) data radio and Single Channel Ground Air Radio System. Each FBCB2 derives its own location via the precision lightweight global positioning system receiver. Through these interfaces, the FBCB2 automatically updates and broadcasts its current location to all other FBCB2-equipped platforms. These radios also transmit and receive C2 messages such as orders, overlays, and reports. The FBCB2 computer is the heart of the system and comes with a keyboard, touch-sensitive screen, and removable hard-disk drive. The system is located inside the vehicle next to the platform commander.

To describe the power of visualization that FBCB2 brings to battalion- and company-level units, a framework is needed to place its importance in perspective. Combat power and its elements provide this framework.

Combat Power and Visualization

Combat power is a commonly used term that describes the resource that commanders use to accomplish the mission. Field Manual (FM) 101-5-1, *Operational Terms and Graphics,* defines combat power as "the total means of destructive and/or disruptive force that a military unit/formation can apply against the opponent at a given time—a combination of the effects of maneuver, firepower, protection, and leadership."[2] Field Manual 3-0, *Operations,* adds information as an element of combat power.[3]

Maneuver. Field Manual 3-0 describes maneuver as "the employment of forces, through movement combined with fire or fire potential, to achieve a position of advantage with respect to the enemy to accomplish the mission. Maneuver is the means by which commanders concentrate combat power to achieve surprise, shock, momentum, and dominance."[4] FBCB2 allows the commander to visualize the effects of terrain, to plan for distributed movement and maneuver, and to monitor execution.

The value of FBCB2 is particularly apparent in two instances of maneuver: the transition from movement to maneuver and the rapid concentration of forces. Using the FBCB2 enemy situational template and the circular line-of-sight tool, leaders can visualize the enemy's maximum engagement line and determine the location of the phase line that triggers

the change in movement techniques from traveling or traveling overwatch to bounding overwatch.

The commander can monitor the progress and formation of subordinate elements and view the transition as units make the appropriate changes. This trigger, which can be rapidly modified via a transmitted overlay or radio call, meets a long-known Combat Training Center (CTC) shortfall of units failing to transition from movement to maneuver.[5] Dismounted infantry units call in enemy spot reports, and the company commander can use a phase line as a trigger to transition from movement to maneuver. Thus, the company commander will have a high probability of gaining visual contact with a small element first, before the enemy gains direct-fire contact on a larger friendly element.

FBCB2 can help maneuver rapidly concentrate forces by generating a geo-referenced icon on all FBCB2 screens. Once the report is posted, units that have been moving or maneuvering dispersed can rapidly move or maneuver to the location and pass through the obstacle breach, choke point, or passage point, or they can link up with another unit. This capability is especially important in limited visibility.

As leaders begin to understand the capabilities of the system, they can develop their own techniques. During field testing, one task force engineer company commander proposed using the bridge report for a breach or bypass. He wanted to speed recognition of the friendly entrance point. Instead of sending out the location as an overlay, which takes time to address, transmit, and bring up, he researched the types of geo-referenced symbols. The bridge report met the need.

The bridge report automatically populates all brigade FBCB2 screens with a bridge symbol at the designated location. A radio call alerts the unit to identify the displayed location and move to its location.[6] As vehicles approach the location, they pick up the far-recognition panel or limited visibility marker and the markings for the entrance to the breach or bypass. This technique cut out the overlay transmission time, populated all brigade screens without having any operator work performed, maintained the common operating picture, and allowed rapid concentration and redispersal of forces.

Firepower. Firepower provides the second element of combat power. Firepower is "the destructive force essential to overcoming the enemy's ability and will to fight."[7] FBCB2 provides a head start on direct and indirect fires that make up firepower. Through spot reports on Red or enemy forces, commanders and crews can make timely decisions on how to control friendly contact with the enemy. Contact with the enemy can be best visualized in terms of time, location, array, and action. At the lowest level of combat, commanders strive to gain visual contact with the enemy before the enemy initiates direct fire. The SA capability allows direct-fire platforms and commanders to picture and construct the engagement so visual contact occurs effectively. The truest indicator of situational dominance is the occurrence of a seamless transition from a digital C2 system screen to gaining contact with the enemy, using direct-fire optics, with no surprises in between.[8]

The value of FBCB2 is particularly apparent in two instances of maneuver: the transition from movement to maneuver and the rapid concentration of forces. Using the FBCB2 enemy situational template and the circular line-of-sight tool, leaders can visualize the enemy's maximum engagement line and determine the location of the phase line that triggers the change in movement techniques.

Using combinations of enemy template overlay, circular, and direct line-of-sight tools, the commander can visualize the best location, array, and action with which to gain visual and direct-fire contact with the enemy. The picture can be portrayed in an overlay and transmitted to subordinate elements as part of the tactical plan. The commander can apply this capability to both offensive and defensive operations.

Once the operation begins, the commander must still control the unit and understand when and how to make adjustments. With the rapid position updates from EPLRS and spot reports from the brigade's complement of reconnaissance assets, the common operating picture gives the commander a large visualization capability. This capability can also have a positive effect on changing the well-known deficiency of company or team fire planning. This deficiency is noted in trend newsletters in terms of mass, leader control, understanding the plan, focused fires, fires distribution, and shifting fires.[9]

The commander can speed reconnaissance by using the Digital Topographic Support System (currently at brigade level), TerraBase (at battalion level), and the FBCB2 line-of-sight tool (at company level) for tentative positions, with subordinate units confirming positions in traditional fashion. FBCB2 range sketches can be consolidated at platoon level into a platoon overlay, sent to the company commander and consolidated, then forwarded to battalion or task-force level. This process can also be extended to observation plans for reconnaissance-based units and for support-area defense plans.

Protection. Protection is the preservation of the fighting potential of a force so the commander

can apply maximum force at the decisive time and place.[10] FBCB2 has functions that significantly add to force-protection capabilities that units already practice.

Each platform equipped with FBCB2 can set the system for audible warnings when approaching danger zones. These zones are related to enemy direct fire (tied to the last FBCB2 spot-reported location and system administrative settings); reported nuclear, biological, and chemical contamination areas; and reported enemy obstacles.

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FBCB2 also affords the commander a capability to reduce fratricide risk. The automatic platform-generated location provides a significant tool for commanders (and all FBCB2 users) to understand spatial relationships and to identify potential fratricide situations before they occur. However, all the friendly units on the battlefield are not necessarily digitized. The commander is still responsible for clearing indirect fires, and each leader or platform commander is responsible for proper target identification.

Leadership. Combat power's leadership component provides purpose, direction, and motivation.[11] The ability to visualize the battlefield is essential in leadership. For the commander to exercise effective, decisive battle command, many different aspects of battlefield visualization must come together accurately.

The primary aspects of visualization that positively affect leadership are the projected and evolving interactions between enemy forces, friendly forces, and the terrain. Inside the tactical operations centers of digitized units, the commander, battle captain, and staff have the means of rapidly visualizing these variables. The commander must formulate his concept to move his unit from the current state to the end state of mission accomplishment. His visualization must include projected enemy capabilities, the area of influence or interest and effects, and the current or projected state of friendly forces.

FBCB2 allows this to happen more effectively. Inside the platform, commanders will have FBCB2. Depending on the unit's training level and application of standing operating procedures, commanders can rapidly see the battlefield plan unfolding and gain an appreciation of evolving risk and opportunity. This picture is also shared with subordinate and higher command elements.

The common operating picture provides leadership-related assistance in two ways: through application of senior experience and through commander-to-commander dialogue. As the senior commander observes the evolving engagement, he can rapidly view the situation and ask a well-timed question to prompt a subordinate commander to take appropriate action. One or two results can occur. The subordinate commander, who is probably in name-tag defilade observing his unit, will take corrective action, or he will inform his senior that the appropriate action is in fact taking place.[12] As commanders talk to each other, the common operating picture provides the means for shared visualization. This results in more accurate dialogue and common understanding of intent.

Just understanding that a particular system has a screen, map, and blue positions is not necessarily enough to signal a qualitative improvement over past battle-command systems. By discussing the application of FBCB2 in terms of combat power, the battlefield visualization's utility and value become apparent, even to commanders who have not yet worked with the system. However, the value that digital C2 brings to leadership warrants a closer discussion.

Information. According to FM 3-0, information enhances leadership and the effects of the other elements of combat power.[13] Using the elements of maneuver, firepower, protection, and leadership allows one to easily see the benefits FBCB2 brings to battlefield visualization. However, using the element of information requires focusing the discussion.

The best way to understand the battlefield visualization utility of digital C2 systems is through the commanders' eyes as they discern risk and opportunity. According to FM 101-5-1, risk is the chance of hazard or bad consequences.[14] The Army concept of battle command is to minimize known or projected battlefield risk or at least make an informed decision to take or assume risk.[15] Clearly, any process or system that enables the commander to rapidly identify risk or battlefield opportunity is beneficial.

In the past, commanders relied on staffs and voice transmissions to articulate portions of the battlefield picture. The staff used charts, push pins, maps, and operational graphics, while radio reports provided lo-

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cation and status. Clearly, the FBCB2 display, constantly updated with positions (for FBCB2-equipped platforms); the latest enemy reports, operational graphics; and intelligence from higher echelon assets provide a better venue for identifying risk and opportunity.

Risk and opportunity have always been on the battlefield. Given a correct assessment, however, there are many reasons that relate to the combat power of information that might prevent the commander from making the appropriate decision. These reasons might be incomplete understanding, cost or benefit of a possible new decision, and higher headquarters approval.

Despite the best efforts of the staff and subordinate commanders, the commander inevitably asks questions about the current situation, especially when the unit is in contact with the enemy. Unanswered questions or information gaps cause the commander to have an incomplete visualization of the battlefield, which results in delayed or discounted decisions.

Another impediment to visualization is the challenge of weighing the benefit of the change against the cost of changing the plan. This is the typical CTC observer/controller (O/C) battle command comment of "fight the enemy, not the plan." This comment revolves around the commander's unwillingness to change the plan because doing so might result in an unraveling of planned battlefield synchronization. The commander is faced with a decision that will in some perceived aspect cause combat power to become unfocused, affect other elements of the unit, or cause other unintended consequences.

The perceived problem of articulating the rationale and decision to the next echelon commander is also an obstacle. In analog units, commanders rely on common maps or graphics to create a verbal picture to justify their decisions. Granted, the next higher commander does not have to approve all changes, but this type of significant decision is the least performed in units and also the type that can now be much more easily justified with FBCB2.

Clearly, commanders of FBCB2-equipped units can be bold and make changes to their decisions with greater confidence, based on better battlefield visualization.[16] If information gaps are present, commanders can discount them, fill them faster, or take them into account. The commander can also better visualize the cost of changing the plan. The mental "what if" and action-reaction-counteraction process can occur more quickly. In some cases, the commander can rapidly synchronize combat-power effects. The common operating picture provides a collaborative environment for dialogue about these significant decisions. Common understanding and better informed decisions can now occur.

Does FBCB2 make bolder commanders? It is hard to say. However, in the Army's current state of transformation, commanders operating with a greater degree of confidence and making better informed decisions might be the result.

Measuring Visualization Effects

Since FBCB2 exists in more than one division and will soon be fielded across III Corps, why are the benefits of battlefield visualization not more apparent? The answer is complex and often lost to the casual observer.[17] Three main issues significantly affect the system's ability to measure or perceive the value or benefit of digital C2 system-supported decisions. The first issue is the inability to measure the quality of the outcome. The second is how to measure combat power in digital units.[18] The third is incomplete training systems.

Fort Hood's III Corps took a tremendous step forward to support digital C2 sustainment training when it fielded the FTI, which allows FBCB2-equipped units to train with FBCB2 without having elements of the brigade or division's signal elements present. In short, the FTI acted as a surrogate headquarters element for connectivity purposes, which allowed units to use FBCB2 routinely in the field and in creative digital C2 sustainment-training events.

Engagements are replicated to near reality and repeated over and over at the National Training Center (NTC)(or any other CTC once digital units become the norm). However, the O/Cs there are not yet prepared well enough to assess the unit's use of digital C2 systems. Although the NTC is "instrumented," valuable battle command assessments still remain focused on analog methods. To remedy this problem, O/Cs should be outfitted with at least the same type of digital C2 system with which the unit comes equipped. Some mechanism for capturing digital C2 data should also be available so O/Cs can coach commanders on how to use information to better picture the battlefield and to make appropriate adjustments.

Combat Training Center O/Cs bring tremendous insight and perspective to training events, yet they are only now able to contribute in a limited fashion to the Army's transformation effort. The Army should take advantage also of data from the numerous training battles. These data would give senior leaders some insight into the progress of the combat unit transformation and identify potential doctrine, organization, training, materiel, leader development, and soldier solutions.

Measuring combat power in digital units is complex. All digitized armor and mechanized infantry battalions were reduced from four maneuver companies to three as they picked up modernized platforms and digital C2 systems. Some subunits were reduced also. The mortar platoon was reduced from six tubes to four, and the scout platoon from 10 vehicles to six. The logistics element of combat battalions also changed. These reductions were necessary for many reasons, but for the most part, they were made to recapitalize portions of the Army.

One can readily see that battalions with three companies, digital C2, and more-capable platforms can fight at least as well as a four-company battalion. At the brigade level, the reduction is more telling. The overall reduction amounts to a battalion (minus) of combat power. The theory behind units that have reduced combat power but enhanced C2 platforms is that they allow battalion or brigade commanders to fight more efficiently. On the other hand, these same units also field the latest model tanks and infantry or cavalry fighting vehicles. Any operational-test officer should be able to see problems arising from any attempt to single out one contributing variable. What is lost in the effort of transformation is the attempt to observe performance differences between smaller digital units and larger analog units.[19]

My own experience, based on two NTC rotations, one with a four-company mechanized infantry battalion and one with a three-company battalion equipped with FBCB2/Army Tactical Command and Control System (ATCCS), provided two unit-level insights: in general, the smaller battalion did not conclude the fight any faster than the larger one did, but in some instances, FBCB2 allowed the smaller battalion to transition faster between missions, especially when finishing a fight at night.[20]

Incomplete Training Systems

The final problem is that of the variables relating to digital C2 training. Training variables can significantly affect a commander's overall ability to visualize the battlefield and make adjustments. Obviously, system operators are the soldiers who receive the training, but some systems also require leader training; however, the pace with which leaders rotate in and out can often marginalize their training.

Under current rules of engagement for equipment fielding, the Army Program Manager is responsible for new-equipment training. When the equipment is upgraded, the program manager is also responsible for "delta" training required to train operators in the latest added capabilities or changes. This can occur quite frequently in an environment of spiral development. Sustainment training to maintain critical skills is most often articulated as a unit responsibility. Most often, the solution is periodic classroom training. Scheduling a classroom, especially at large installations, is an obstacle, however. What commanders need but do not have is an inexpensive solution that will enable the unit to train on its own systems

as part of normal garrison training events.

Even in the best circumstances, operator-training skills can degrade over two to three months. My personal experience indicates that my operators needed routine training on FBCB2 at least once a month while in garrison. Also, they needed to train on incorporating specific digital C2 tasks into each field event. Fort Hood's III Corps took a tremendous step forward to support digital C2 sustainment training when it fielded the FTI, which allows FBCB2-equipped units to train with FBCB2 without having elements of the brigade or division's signal elements present. In short, the FTI acted as a surrogate headquarters element for connectivity purposes, which allowed units to use FBCB2 routinely in the field and in creative digital C2 sustainment-training events. However, commanders must still make tough decisions to leverage limited training opportunities. Digital C2 system training is a prime area for "Sergeants' Time" as described by Command Sergeant Major (CSM) James DePriest, a former CSM for the 1st Brigade Combat Team, 4th ID, who had three years experience with FBCB2.[21]

The current group of commanders of FBCB2-equipped units is voicing an insight with which most commanders will agree. Once units become digital, sustainment training should not entail going back to a centralized classroom. Units need to conduct sustainment training as part of routine business inside their own footprint.[22] The lack of a resourced Armywide digital training strategy compounds this specific training problem. However, there are units and installations that are moving to implement unique solutions.[23]

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FBCB2 can provide battalion, company, platoon, and vehicle commanders the ability to maneuver better, apply firepower more effectively, assume better protective postures, and take advantage of a chaotic battlefield. However, these benefits are not clearly measurable in most instances because of inadequate measuring processes, force reductions, other equipment fieldings, and inadequate sustainment-training support. In an age of fiscal competition, the Army will have to confront these issues to justify digital C2 systems and to continue to set the conditions for a successful Transformation. ***MR***

NOTES

1. U.S. Army Field Manual (FM) 101-5-1, *Operational Terms and Graphics* (Washington, DC: Government Printing Office (GPO), 30 September 1997), 1-18; FM 71-1, *Tank and Mechanized Infantry Company/Team* (Washington, DC: GPO, 26 January 1998), chapter 2; *see also* FM 71-100, *Division Operations* (Washington, DC: GPO, 28 August 1996) *and* FM 71-3, *The Armored and Mechanized Infantry Brigade* (Washington, DC: GPO, 11 May 1988).
2. FM 101-5-1, 1-31.
3. FM 3-0, *Operations* (Washington, DC: GPO, 14 June 2001), 4-3.
4. Ibid., 4-4.
5. U.S. Army Center for Army Lessons Learned (CALL), "NTC Trends and TTPs" (01-12), (Fort Leavenworth, KS), Maneuver Trend 7–Movement to the Objective.
6. This point is important because units in contact should be focused on gaining visual contact with the enemy, not necessarily looking at a screen.
7. FM 3-0.
8. The timing of observing the FBCB2 screen depends on the activity of the platform commander. Before the line of departure, the commander might be viewing the screen frequently. After crossing the line of departure, platform commanders should attempt to gain visual contact with the enemy. Under no normal circumstances should a platform commander visually contact the enemy by looking at a screen.
9. *See* CALL, "CTC Newsletter" (4Qtr FY94), *and* CALL "Special Study, Mar 98: Closing with the Enemy: Company Team Maneuver."
10. FM 3-0, 4-8.
11. Ibid., 4-7.
12. Two personal examples come to mind. I once asked a company commander why a section was moving out of the support-by-fire position. The company commander said the templated position was not, in fact, the best place to be, and he was moving a section forward to the next intervisibility line. At another time, I observed a company's movement stray from the planned axis of advance. Once cued, the commander was able to get his unit back under control.
13. FM 3-0, 4-10.
14. FM 101-5-1.
15. Ibid., 1-134; FM 3-90, *Tactics* (Washington, DC: GPO, 4 July 2001), 1-12.
16. A commander could identify risk by looking at the spatial relationship with the enemy and between Blue forces and graphic control measures; between Blue elements or units; Blue forces and terrain; and so on. Familiarity with the plan, knowledge of the current situation, and a quick glance at the screen is sometimes all a commander needs to make a quick assessment. This does not relieve any commander from performing the necessary risk assessment before the operation begins.
17. *See* U.S. Government Accounting Office (GAO)/National Security and International Affairs Department (NSIAD)-99-150, *Battlefield Automation: Performance Uncertainties are Likely When Army Fields Its First Digitized Division* (Washington, DC: GAO, July 1999).
18. The terms "digital" unit and "analog" unit oversimplify the strengths and weaknesses of both types of units.
19. LTC John Hadjis, "Making Art Out of Digits," *Armor* (January–February 2002), 24. During NTC Rotation 00-10, Hadjis commanded a small tank battalion that was FBCB2-equipped. His opposing force (OPFOR) kill ratio was almost twice that of larger units.
20. I was S3, 1-16th ID (M), for NTC Rotation 95-05. Task Force 1-16 ID was organized with two mechanized infantry companies, two tank companies, one antitank company, and one engineer company. During NTC 00-10, I was battalion commander, 1-22 ID (M), organized with two mechanized infantry companies, one tank company, and one engineer company. Rapid transitions were not caused by less equipment, but by an application of FBCB2 to speed the process. In one isolated mission, my smaller unit exceeded the performance of the larger unit. To my knowledge, the only OPFOR difference between these two rotations was the OPFOR's change from the Soviet-based model to a more flexible operational concept. In other words, the size of the OPFOR was not reduced.
21. CSM James L. DePriest, "Sergeants' Time XXI," *Armor* (January–February 2002), 22. DePriest's task list is especially prescient in that he emphasizes conducting pre-contact inspections and troubleshooting equipment for which the soldier or unit is responsible.
22. An example is the training technique for command maintenance. As part of command maintenance, the unit can power up digital systems and establish connectivity. Some systems have an embedded tutorial that operators can use as the basis for the training event. Missing, however, is the training-sustainment solution to support the higher level leader skills needed to fully leverage these new systems. A unit-owned, low-cost, scenario-driven system that would allow interaction between platforms and leaders would be a welcome addition.
23. The best example is the U.S. Armor Center, 16th Cavalry Regiment, whose Digital Battle Command Suite is a unique, low-cost, U.S. Army Training and Doctrine Command-exportable training system that will yield terrific results for units that receive these particular career-course graduates.

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